TITLE OF THE INVENTION

DISC CARTRIDGE AND DISC DRIVE APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of Korean Application No. 2001-26784, filed May 16, 2001, in the Korean Industrial Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates to a disc cartridge that accommodates an information recording and/or reproduction medium, and more particularly, to a disc cartridge and a disc drive apparatus having an improved identification mechanism to identify types of discs.

Description of the Related Art

[0003] In general, a disc cartridge is used in a disc drive and accommodates a disc-type recording and/or reproduction medium, such as an optical disc or magnetooptical disc. The disc cartridge is widely used as a recording medium for multimedia such as video and sound as well as for text and images. With the continued development of multimedia, a disc cartridge having a large capacity is required. As such, various types of disc cartridges have been developed that accommodate a disc having an improved recording density. For example, in the case of a DVD-RAM, there are various types of discs such as a general single-sided type disc (where information is recorded on only one side thereof), a double-sided type disc (where information is recorded on both sides thereof), a single-sided, double-layer type disc (where two recording layers are formed on one side thereof), and a disc where a track pitch is relatively narrow as compared to the general single-sided type disc. Thus, a variety of type of disc cartridges which can accommodate the above discs having various types of recording density are provided.

[0004] However, when the recording density varies, a recording and/or reproduction method performed by a disc drive apparatus varies accordingly. That is, the disc drive apparatus performs a method of recording or reproducing information according to the structure of a track pitch of a disc or according to the type of a layer of a disc, such as a single layer or double

layer. Thus, the disc drive apparatus needs a mechanism to detect the type of the disc when the disc cartridge accommodating the disc is inserted into the disc drive apparatus.

[0005] FIG. 1 shows a conventional mechanism to detect the type of a disc, an example of which is disclosed in Japanese Patent Publication No. 11-120733. Referring to FIG. 1, a magnet 5, which is used to identify a large capacity disc, is installed at a disc cartridge 1. The disc cartridge 1 rotatably accommodates a disc 2 in a case 3. A magnetic sensor 7, which detects the magnet 5, is installed at a disc drive apparatus 6. Thus, when the disc cartridge 1 is inserted in the disc drive apparatus 6, the magnetic sensor 7 detects a magnetic force of the magnet 5 to determine that the disc 2 in the disc cartridge 1 has a large capacity. Then, the detected result is transmitted to a controller (not shown) of the disc drive apparatus 6 so that the controller can control the recording and/or reproduction according to the type of the disc 2.

[0006] However, when a disc 2 has a small capacity, the magnet 5 is not installed. Thus, when the disc cartridge 1 accommodating the disc 2 having a small capacity is inserted in the disc drive apparatus 6, the magnetic sensor 7 does not detect a magnetic force. As such, the disc drive apparatus 6 determines that the disc 2 in the disc cartridge 1 is a disc 2 having a small capacity.

[0007] In the above conventional apparatus, since the type of the disc 2 is detected by the on/off state of the magnetic sensor 7 according to the presence or absence of the magnet 5, only two types of a disc (i.e., a high capacity or a small capacity) can be detected. Thus, to detect a variety of types of discs 2, the number of the magnets 5 should be increased. Accordingly, the corresponding number of the magnetic sensors 7 are installed so that the type of the disc 2 is detected using the ones of the magnetic sensors 7 that are turned on.

[0008] According to another method, by installing the magnets 5 having different magnetic forces according to the types of discs 5, the type of the disc 5 is detected. In this case, it is necessary to install a circuit that is accurate in detecting different magnetic force intensities instead of just detecting an ON and an OFF state.

[0009] According to these conventional apparatuses, increasing the number of the magnetic sensors 7 prevents manufacturing smaller and lighter disc drive apparatuses 6 while increasing the manufacturing cost and lowering productivity. Also, detecting the type of a disc 2 by using different magnetic forces needs an accurate circuit that exacerbates these problems. Further,

when the magnetic force deteriorates, there is a possibility that the type of the disc 2 would be incorrectly determined.

[0010] Therefore, a disc cartridge and a disc drive apparatus having an improved, but simpler structure to detect the various types of discs is needed.

SUMMARY OF THE INVENTION

[0011] To solve the above and other problems, it is an object of the present invention to provide a disc cartridge and a disc drive apparatus which can distinguish a variety of types of discs to determine the type of the disc accommodated in the disc cartridge with a simpler structure.

[0012] Additional objects and advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

[0013] To achieve the above and objects, a disc cartridge has a disc having information to be recorded and/or reproduced using a disc drive apparatus, the disc cartridge according to an embodiment of the invention including a case to rotatably accommodate the disc, and an identification unit disposed on the case to identify a type of the disc by selectively contacting a predetermined probing portion of the disc drive apparatus to produce a sequence of identifying information.

[0014] According to another embodiment of the present invention, a disc drive apparatus includes a recording and/or reproduction unit to recording and/or reproduce information with respect to a disc accommodated in a disc cartridge, and a probing portion to identify a disc by selective interference with an identification plate provided at the cartridge to produce a sequence of identifying information.

[0015] According to yet another embodiment of the invention, a disc identification mechanism includes identification openings on a disc cartridge having states to identify a type of the disc, and a probing portion on a disc drive apparatus to identify the type of the disc by selective interference with identification plates disposed in the identification openings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The above object and advantages of the present invention will become more apparent and more readily appreciated by describing in detail embodiments thereof with reference to the accompanying drawings in which:

FIG. 1 is a perspective view showing a disc cartridge and disc drive apparatus having the conventional disc identification mechanism;

FIG. 2 is a perspective view showing a disc cartridge and a disc drive apparatus having a disc identification mechanism according to an embodiment of the present invention;

FIG. 3 is an exploded perspective view of the disc cartridge of FIG. 1;

FIG. 4 is a magnified plan view showing the identification hole of FIG. 3;

FIG. 5A is a sectional view taken along line C-C of FIG. 4;

FIG. 5B is a sectional view taken along line D-D of FIG. 4;

FIG. 6 is a view showing a state in which a probe switch of a probing portion is in an ON state;

FIG. 7 is a view showing a state in which a probe switch of a probing portion is in an OFF state;

FIG. 8 is a perspective view showing a disc cartridge and a disc drive apparatus according to another embodiment of the present invention; and

FIG. 9 is a view showing the relation between the disc cartridge and the probing portion.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0017] Reference will now be made in detail to the present embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to the like elements throughout. The embodiments are described below in order to explain the present invention by referring to the figures.

[0018] Referring to FIGS. 2 and 3, a disc cartridge 10 includes an upper case 11 and a lower case 12. A disc 14, which is a information recording and/or reproduction medium, is accommodated between the upper and lower cases 11 and 12. An opening cover 13 is provided so that the disc 14 can be inserted into or removed from the disc cartridge 10. Openings 17, along which an optical pickup device 113 moves in a radial direction of the disc 14 when the disc cartridge 10 is loaded in a disc drive apparatus 100, are installed at the upper

case 11 and the lower case 12, respectively. A shutter 19 to prevent intrusion of foreign materials such as dust into the disc cartridge 10 is slidably installed to cover the openings 17.

[0019] A plurality of identification openings 20 are formed in each of the upper and lower cases 11 and 12 at a constant interval in-line with a direction in which the disc cartridge 10 is loaded into the disc drive apparatus 100 (i.e., a direction indicated by an arrow A). As such, the identification openings 20 are in-line with a direction of relative movement between the disc cartridge 10 and the disc drive apparatus 100. It is understood that the opening 17, the shutter 19, and the identification openings 20 need only be provided on one of the upper and lower cases 11 and 12 if the disc 14 has only a single recording surface.

[0020] Referring to FIGS. 2, 4, 5A and 5B, an identification plate 22 is disposed in each of the identification openings 20. The identification plate 22 has protruding portions 22a formed at both ends of the identification plate 22. The identification plate 22 is capable of sliding in a direction perpendicular to the direction A. An adjustment hole 23 is formed at a central portion of the identification plate 22. Thus, the identification plate 22 can slide to the left and right in FIG. 4. The position thereof can be changed by putting a tip of an object (not shown), such as a ballpoint pen or pencil, into the adjustment hole 23. According to the position of the identification plate 22 in each of the identification openings 20, a probing rod 121 of a probing portion 120 is pressed or is not pressed to turn ON or OFF the probing portion 120 so that the type of the disc 14 can be identified. The above operational mechanism will be described later in greater detail.

[0021] A hooking portion 24 extends a predetermined length from the identification plate 22 and is provided at both ends of the identification plate 22 in a direction E shown in FIG. 5A within each of the identification openings 20. A guide groove 25 is formed at both ends of each of the identification openings 20 corresponding to the hooking portion 24. A hooking step 26 protrudes from the bottom surface of the guide groove 25. Thus, as the identification plate 22 slides in the guide groove 25, the hooking portion 24 is hooked by the corresponding hooking step 26 of the guide groove 25 so that the identification plate 22 is fixed at an end of the identifying opening 20. It is understood that the hooking portion 24 can be formed extending into the guide groove 25 to hook a corresponding hooking step 26 disposed on an end of the identification plate 22. It is further understood that other mechanisms are available to selectively fix the identification plate 22 at an end of the identifying opening 22 to provide a state for the identification opening 22.

[0022] The hooking portion 24 and the guide groove 25 can be easily formed using injection molding. Since the hooking portion 24 itself has an elastic force, as indicated by a dashed line in FIG. 5A, it can move elastically while being hooked by the hooking step 26. However, it is understood that the hooking portion 24 and guide groove 25 can be formed using other methods and attached using non-elastic mechanisms.

[0023] In the embodiment of the present invention shown in FIG. 2, three identification openings 20 are formed. However, the number of the identification openings 20 is not limited thereto and may increase or decrease as the standard of identification of a disc 14 varies.

[0024] Each of the identification openings 20 indicates a different feature of a disc. For example, an identification opening 20a indicates a type of the disc 14 as a 12 cm disc or an 8 cm disc. An identification opening 20b indicates whether the disc 14 is a single-sided disc or double-sided disc. An identification opening 20c indicates the state of the disc 14, such as whether the disc 14 is read-only or is recordable, whether the disc 14 is write protected, whether the disc 14 has narrowed tracks, or whether the disc 14 has multiple recording layers per side.

[0025] The disc cartridge 10 includes position determination holes 15 into which position determination pins 114 of the disc drive apparatus 100 are inserted to determine and/or position the disc cartridge 10.

[0026] As shown in FIGS. 2, 6 and 7, the disc cartridge 10 is placed on a tray 130 and is loaded into the disc drive apparatus 100. A pivot chassis 110 is installed at the disc drive apparatus 100 which pivots by a predetermined cam mechanism (not shown) up and down in a direction B (see FIG. 2). A recording/reproduction unit includes a turntable 112 onto which the disc 14 is placed, and a spindle motor 111 to drive the turntable 112 to rotate. An optical pickup 113 to record and/or reproduce information with respect to the disc 14 is installed on the pivot chassis 110.

[0027] An upper cover 140 is installed at the upper portion of the disc drive apparatus 100. The probing portion 120 is installed at the upper cover 140 opposite the identification openings 20. The probing portion 120 is pressed or not pressed by the identification plates 22 as the disc cartridge 10 moves past the probing portion 120 while being loaded into the disc drive apparatus 100 so that the disc 14 can be identified. As such, the probing portion 120 is selectively activated due to the relative motion of the identification holes 20.

[0028] The probing portion 120 includes the probing rod 121, a probing sensor 122, and a probing switch 123. The probing rod 121 is formed to be pressed. When the disc cartridge 10 is loaded into the disc drive apparatus 100, the probing rod 121 is pressed by the identification plate 22 in the direction F, and the probing switch 123 is turned ON by the probing sensor 122. When the probing rod 121 is not pressed, the probing switch 123 is turned OFF. Here, the probing portion 120 is connected to a microcomputer 200 which determines the ON/OFF state of the probing switch 123 as part of an identifying sequence to identify the type of the disc 14. The probing portion 120 is not limited to the above shown in the drawing and a various modifications thereof having the same function are possible. For instance, it is understood that the probing portion 120 could be an optical or magnetic switch that sequentially reads reflected light or detects magnets to obtain the identifying sequence. Further, it is understood that the probing portion 120 could be disposed on a movable track (not shown) to move past the disc cartridge 10.

[0029] The pivot chassis 110 ascends when the tray 30 is loaded and descends when the tray 30 is unloaded. When the tray 130 is loaded, the disc 14 in the disc cartridge 10 is placed on the turntable 112 and the position determination pins 114 are inserted in the position determination holes 15.

[0030] The method of identifying the type of the disc 14 accommodated in the disc cartridge 10 loaded in the disc drive apparatus 100 having the above structure is described as follows. It is understood that the microcomputer 200 can identify the sequence of signals using software encoded on a computer readable medium.

[0031] FIG. 6 shows the probing switch 123 of the probing portion 120 in the ON state, and FIG. 7 shows the probing switch 123 in the OFF state. Referring to FIG. 6, when the disc cartridge 10 is placed on the tray 130 and is loaded into the disc drive apparatus 100, the pivot chassis 110 ascends in the direction B (see FIG. 2) to place the disc 14 on the turntable 112. Here, the probing portion 120 is sequentially disposed above the identification plate 22 of each of the identification openings 20 as the disc cartridge 10 moves in the direction A into the disc drive apparatus 100. Thus, when the disc cartridge 10 is placed on the tray 130 and is then loaded into the disc drive apparatus 100, the probing rod 121 contacts and slides over ones of the identification plates 22 to be turned ON, and is received into ones of the identification holes 20 to be turned OFF. Specifically, where the identification plate 22 is at an end of the identification opening 20 to be contacted, the probing rod 121 is pressed by the identification

plate 22 in a direction F as the probing portion 120 moves relative to the identification opening 20. As the probing rod 121 is pressed, the probing sensor 122 coupled to the probing rod 121 moves in the direction F and contacts the probing switch 123. The probing switch 123 is then in the ON state. A signal indicating the ON state is transmitted to the microcomputer 200 so that a feature of the disc 14 is identified.

[0032] In FIG. 7, the probing rod 121 is disposed not to be in contact with the identification plate 22. When the disc cartridge 10 placed on the tray 130 and is loaded into the disc drive apparatus 100 in the A direction, the identification plate 22 is at an end of the identification opening 20 not to be contacted by the probing rod 121. Thus, the probing rod 22 is not pressed when pressing over the identification opening 20 such that the probing sensor 122 does not contact the probing switch 123 and is in the OFF state. A signal indicating the OFF state is transmitted to the microcomputer 200 so that a feature of the disc 14 is identified.

[0033] Meanwhile, three identification openings 20a, 20b, 20c are formed in the disc cartridge 10. The identification openings 20a, 20b, 20c turn the probing switch 123 ON/OFF according to the position of the identification plates 22 to generate an identification sequence for features of the disc 14. For example, the identification opening 20a identifies the size of the disc 14 to be 12 cm when the probing rod 121 is pressed by the identification plate 22. When the probing rod 121 is not pressed, the size of the disc 14 is identified to be 8 cm. The identification opening 20b identifies whether the disc 14 is a single-sided disc when the probing rod 121 is pressed by the identification plate 22. When the probing rod 121 is not pressed, the disc 14 is identified to be a double-sided disc. The identification opening 20c identifies the disc 14 to be a read-only disc when the probing rod 121 is pressed by the identification plate 22. When the probing rod 121 is not pressed, the disc 14 is identified to be a read/write disc. Of course, the position of the identification plate 22 is not limited to the above and can be arbitrarily changed. Also, the number of the identification openings 20 may be increased or decreased as needed.

[0034] That is, when the disc 14 is an 8 cm, single-sided, and read-only disc, the identification plate 22 of the identification opening 20a is disposed not to contact the probing rod 121, the identification plate 22 of the identification opening 20b is disposed to contact the probing rod 121, and the identification plate 22 of the identification opening 20c is disposed not to contact the probing rod 121. Then, when the disc cartridge 10 is loaded into the disc drive apparatus 100 and moves in the A direction, the probing switch 123 is sequentially turned OFF,

ON, and OFF to generate an identification sequence so that the microcomputer 200 identifies the type of the disc 14.

[0035] In the shown embodiment, assuming that both sides of the disc 14 inserted in the disc cartridge 10 are used, the identification openings 20 are formed at the upper case 11 and the lower case 12. Thus, when the disc cartridge 10 is inserted upside down, the same identification operation is performed by the probing portion 120. However, it is understood that if both sides of the disc 14 are not used, the identification openings 20 need not be on both the upper and lower cases 11 and 12.

[0036] FIG. 8 shows a disc cartridge 10 and a disc drive apparatus 100 according to another embodiment of the present invention. Here, the same reference numerals indicate the elements having the same functions. The structure of the embodiment shown in FIG. 8 is substantially the same as that of the embodiment shown in FIG. 2. However, the identification openings 20' are formed at the left and right sides of the disc cartridge 10. The probing portion 120 is installed at the side surface of the disc drive apparatus 100 corresponding to the identification openings 20'. A lengthwise guide groove 131 is formed at the tray 130.

[0037] When the tray 130 is loaded or unloaded with respect to the disc drive apparatus 100 in the A direction, the probing portion 120 is guided by the guide groove 131. When the disc cartridge 10 placed on the tray 130 and is loaded into the disc drive apparatus 100, the probing rod 121 of the probing portion 120 selectively contacts the identification plates 22 of the identification openings 20'a, 20'b, 20'c and is sequentially pressed or is not pressed thereby so that the probing switch 123 is turned ON or OFF while passing over the identification openings 20'a, 20'b, 20'c.

[0038] FIG. 9 shows the relationship between the disc cartridge 10 and the probing portion 120. The probing portion 120 is provided at the side of the disc cartridge 10 having the identification opening 20'. In the shown embodiment, three identification openings 20'a, 20'b, 20'c are provided. When the disc cartridge 10 is loaded into the disc drive apparatus 100, the probing rod 121 is pressed or not pressed by each of the identification openings 20' 20'a, 20'b, 20'c as the disc cartridge 10 is loaded. Thus, the probing switch 123 is turned ON or OFF and the type of the disc 14 is identified by the microcomputer 200 according to this sequence. While not shown, it is understood that individual probing portions 120 could be simultaneously placed in the locations shown in FIGs. 2 and 8.

[0039] As described above, in the disc cartridge and disc drive apparatus according to the present invention, since the identification openings and the selective presence of the identification plate can be identified by a single probing portion installed in the disc drive apparatus to determine various types of discs, it is economical and productivity improves. Also, when an additional identification function with respect to the disc is to be added, additional identification openings are added to the disc cartridge such that no additional probing portions are required to detect the additional identification function. However, it is understood that additional locations for the identification holes and probing portions are possible, and that it would be possible to use additional probing portions in different locations and different identification sequences according to the present invention.

[0040] Although a few embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.